DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND OR 97208-2870

REPLY TO
AITENTION OF

CENWD-PM-P 14 April 2004

MEMORANDUM FOR CDR HQUSACE, (CECW-NWD REGIONAL INTEGRATION TEAM), 440 G STREET, WASH DC 203 14-1000

SUBJECT: Jackson Hole, Wyoming, Upper Snake River Restoration Project: Request for ASA(CW) Concurrence – Sponsor Credit for Work Performed Prior to Signing of Project Cooperation Agreement

1. Enclosed for your action is the Walla Walla District request for approval of sponsor credit on the subject project. This enclosure is provided to request ASA(CW) concurrence of a sponsor credit for performed work that is integral to the Jackson Hole, Wyoming project, as defined in WRDA 2000, Section 101 (b) (28) JACKSON HOLE, WYOMING. (B):

> *(ii) CREDIT.—The Secretary shall credit toward the non-Federal share of the cost of the project the cost of design and construction work carried out by the non-Federal interest before the date of execution of a cooperation agreement for the project if the Secretary determines that the work is integral to the project.*

2. The enclosure provides the description of work performed by the sponsor and justification for the sponsor credit.

3. Request that the Secretary concur with the Walla Walla District determination and find the work integral to the project, or delegate the authority for that determination to the Northwestern Division or CENWW.

4. If there are any questions please contact Ed Woodruff, 503-808-3850.

FOR THE COMMANDER:

/signed/

Encl

G. WITT ANDERSON
Chief, DST Fish/NWP/NWW

CF:
CENWD-CM-F
CENWW-PD-EC

DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT CORPS OF ENGINEERS
2C1 NORTH THIRD AVENUE
WALLA WALLA. WASHINGTON 99362-1876

REPLY TO
ATTENTION OF

CENWW-PM-PD-EC (1105-2-10a)

5 MAR 04

MEMORANDUM FOR Commander, Northwestern Division
(CENWD-CM-CM/Joseph Johnson), 220 NW Eighth, Portland, OR 97209-3589

SUBJECT: Request for ASA(CW) Concurrence – Sponsor Credit for Work Performed Prior to Signing of Project Cooperative Agreement (PCA) for the Jackson Hole, Wyoming, Upper Snake River Restoration Project

1. The Walla Walla District (NWW) determined the non-federal sponsor for the subject project performed work integral to the project, prior to the signing of a PCA. The enclosure provides the determination by NWW regarding the details of the non-Federal sponsors' demonstration project and the rationale for its being integral to the project.

2. Non-Federal sponsors for the subject project are eligible for General Construction (CG) project credit under language authorized by the Water Resources Development Act (WRDA) 2000 [PL 106-541 Section 101(b)(28)]. The project credit is contingent on a finding by the Secretary that the work is integral to the project.

3. The Chief's Report does not make a specific finding the work is integral to the project.

4. Request that the Secretary concur with the NWW determination and find the work integral to the project, or delegate the authority to the Northwestern Division or NWW.

5. Your assistance in expediting this effort is greatly appreciated. The project is strongly supported by the Wyoming Congressional Delegation, Senator Craig Thomas (R), Senator Michael Enzi (R), and Congresswoman Barbara Cubin (R. at large).

6. Any questions regarding the contents of this package may be referred to Mr. Stan Heller, Project Manager, at 509-527-7258.

/signed/

Encl

EDWARD J. KERTIS, JR.
LTC, EN
Commanding

Details and Rationale for Demonstration Project Work
As Integral to the Jackson Hole USRRP Project

Background: Language in Water Resources Development Act (WRDA) 2000 [PL 106-541 Section 101(b)(28)] authorizes the non-Federal interest to receive credit toward the non-Federal share of project costs for design and construction work carried out before the date of execution of a Project Cooperative Agreement (PCA), if the Secretary finds that the work is integral to the project. While there is no specific mention in the Chiefs Report, the Sponsor's demonstration project at Site 9 is integral to the Jackson Hole Upper Snake River Restoration Project (USRRP). The portion of the demonstration project constructed prior to the Chiefs Report is documented in the Feasibility Report. The sponsor has submitted documentation for demonstration project costs of $472,237. The non-federal project cost share is $23,275,000.

Findings: Plate 34 of the Feasibility Report (see attachment 1) identifies the Feasibility Report's proposed location for 6 eco-fences, 6 off-channel ponds, and channel capacity excavation. The Sponsors demonstration project was constructed in 3 parts, during 1998, 1999 and 2001. The project constructed 6 Pools, 5 eco-fences and 36,000 cubic yards of channel excavation (downstream of cross-section 903 (R3)). Section 9.1 of the Feasibility Report documents the work completed in 1998 and 1999 (see attachment 2).

The eco-fences were constructed and in place prior to June 1999, when the site experienced a high spring runoff condition (1% chance flood event). The fences protected the island against the high water and the river island would likely have experienced additional damage and habitat degradation, had the fences not been in place. The fences were damaged by the high river flows, and by learning from the result, the subsequent fence design, during Preconstruction, Engineering and Design (PED), was improved in order to prevent damage to the fences from river scour by:

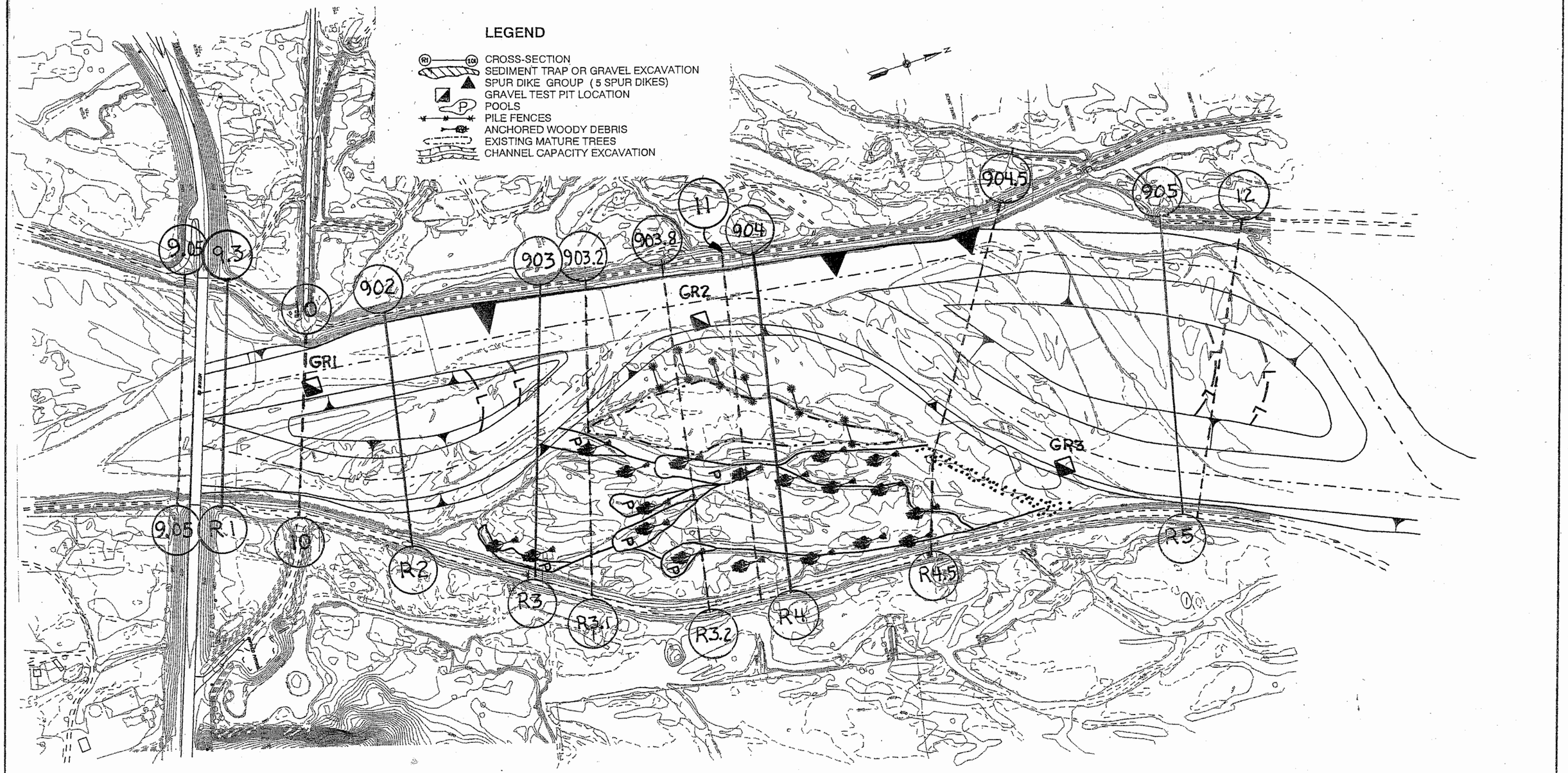
- lengthening the depth of the outermost post pilings from 20 to 40 feet,
- narrowing the spacing of the outermost pilings from 10 to 5 feet,
- adding rock to the outermost piling,
- adding screen to the cattle panels.

Conclusion: The Sponsors' demonstration project at Site 9 is integral to the USRRF' project. Had the Sponsors not constructed the demonstration, the project would have needed to construct the same features, at escalated cost and would not have benefited from the fence redesign improvements.

Recommendation: I have determined that the above described work carried out by the project sponsors, before the date of execution of a Project Cooperative Agreement (PCA) is integral to the USRRP project. I recommend a concurrence letter be forwarded to Northwest Division requesting the Secretary (ASA(CW)) concur with the Walla District's determination that the work is integral to the USRRF' project.

\signed\ 3/3/04

Stan Heller Date
Project Manager
Jackson Hole USRRP Project



AREA 9
SCALE IN FEET
200' 0 200'

NOTE: Ranges R1-R5 were surveyed in the fall of 1996. Range 9.05 was derived from 9..3. Ranges 10, R3.2, R3.8, R4.5, and 12 were developed from 1996 topography with estimated low-flow channel. Range 11 was derived from R4. Topography for this map was based on 1996 photogrammetry.

Snake River at Jackson Hole
CROSS-SECTION LOCATIONS
AREA 9

U. S. Army Corps of Engineers
Walla Walla District
Hydrology Branch

30 September 1998

ATTACHMENT 1

PLATE 34

Final Report

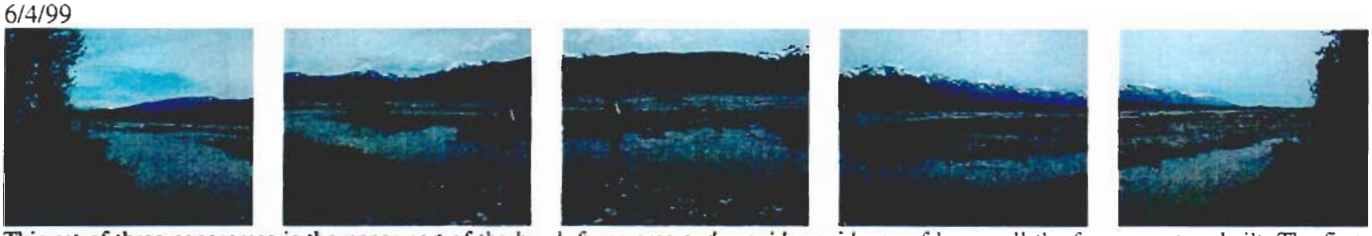
Prepared January 2000

by
Rik Gay
Executive Director, Teton Conservation District

Snake River Restoration

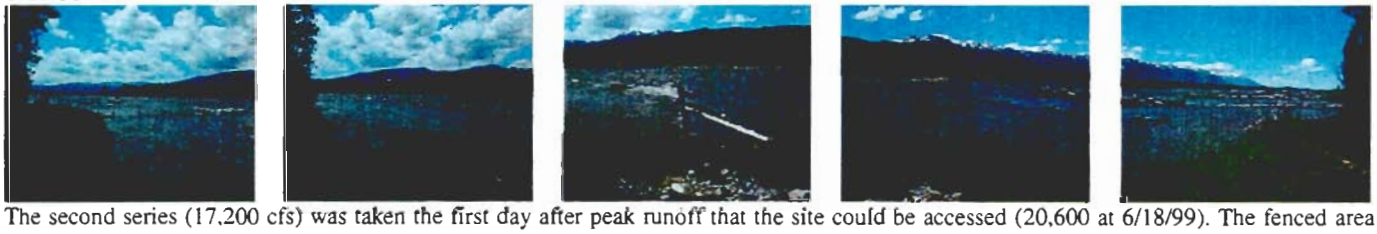
Demonstration Project #99-068

6/4/99



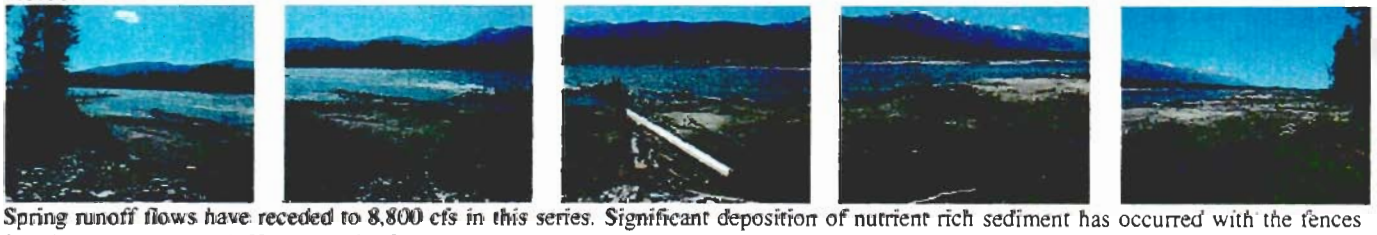
This set of three panoramas is the upper part of the brush fence area and provides evidence of how well the fences captured silt. The first series was taken at river flows of 15,900 cubic feet per second. The water had only appeared the day before in the fenced area and is "subbing" up e.g. ground water pooling at this point. Note the distance the main channel of the river is from the end of the fences. At low flow the edge of the channel was at least 40 meters from the fence in this location.

6/25/99



The second series (17,200 cfs) was taken the first day after peak runoff that the site could be accessed (20,600 at 6/18/99). The fenced area has had river flows passing through for about 15 days at this point. Note that heavy current impinging on the end of the fence at left and that the main channel of the river is trying to shift into the fenced area but is being diverted away by the fences.

7/9/99

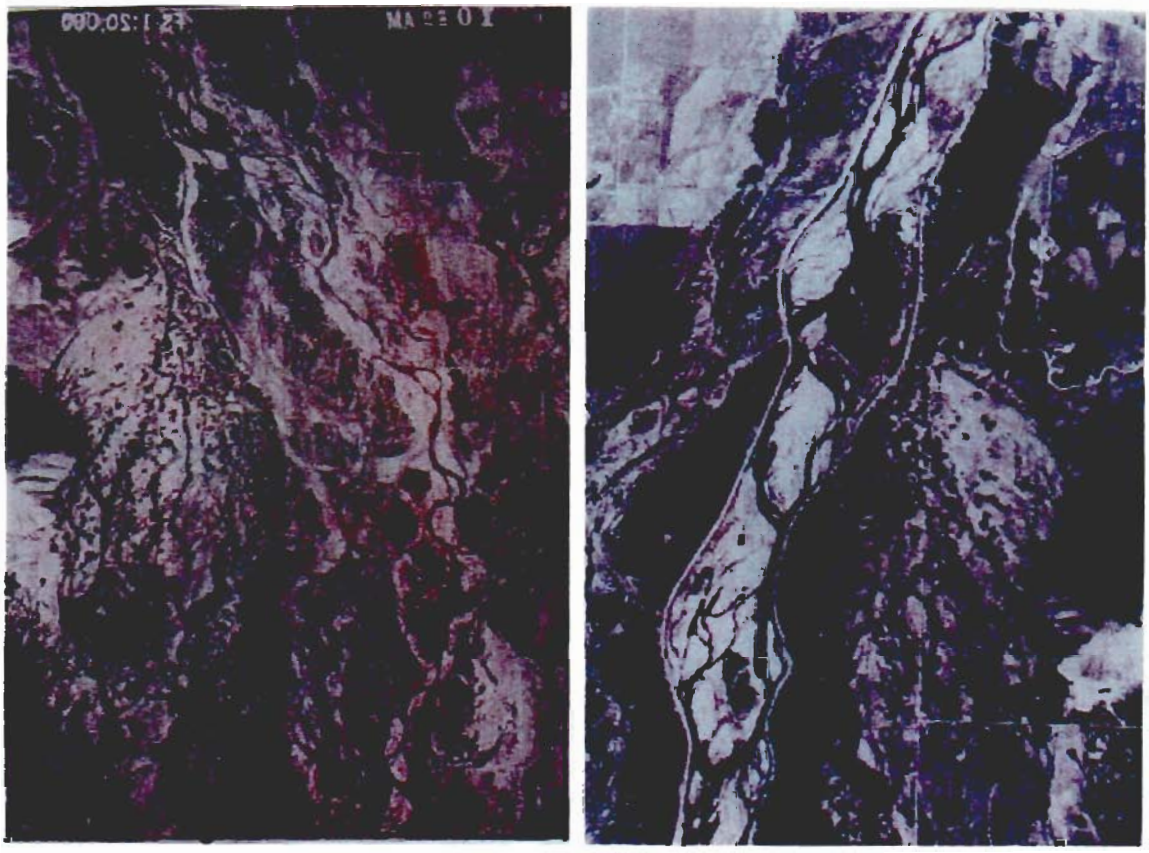


Spring runoff flows have receded to 8,800 cfs in this series. Significant deposition of nutrient rich sediment has occurred with the fences functioning as expected. However, the fences were not designed to withstand a direct attack from such high velocities as was experienced during this event which were up to 15 feet per second in this case. Prior to runoff, the main channel of the river was well out from the fenced area. As you compare this series with that taken on June 6th you can see that the main channel has completely shifted from river right to river left. Consequently, had the fences not been in place the lower third of this island would have been attacked by the main current and would have been eroded away. To have the fences function as island protection was an unanticipated bonus.

INTRODUCTION

The Teton Conservation District (formerly known as the Teton County Natural Resource District) is involved in a collaborative environmental study of the Snake River ecosystem assessing historical, existing, and potential future conditions of the riparian, riverine, and wetland habitats. The Snake River is of particular interest for several important ecological reasons. First and foremost, the Snake is one of the few remnant strongholds for a native fish population, the Finespotted Snake River Cutthroat trout. The ecosystem also provides habitat for a great number of bird species including many different varieties of waterfowl, Bald and Golden eagle populations, Osprey, and Trumpeter swans. It also supplies important habitat for elk, moose, deer, Grizzly and Black bear.

With the increased velocities created by the constriction of the Snake River floodplain within the Federal levee system, the islands and exposed stream banks within the system have become unstable. That instability has created a loss of valuable riverine, riparian, wetland, and associated habitats, including fisheries. The net loss of these desirable habitats within the leveed reach has been estimated at approximately 80-90% since 1956.



The aerial photos above illustrate the impact the levees have had on riverine habitat. The mirror images are of the same area on the Snake River just below the Wilson bridge. The photo on the right was taken in 1955 pre-levee and the one on the left in 1978 post-levee.

Aggradation of bedload material as indicated here was occurring in a number of areas along the leveed reach. Most notably in the Gros Ventre / Snake River confluence, at the Snake River Bridge, and at the lower end of the leveed reach.

It has been established through sediment range surveys first completed in 1954 that there are several sites along Snake River's levee reach that have experienced excessive aggradation of bedload material. This aggradation causes severe channel instability and diminished flood capacity in these areas.

While a significant amount of river restoration work is taking place in many different watersheds throughout the country, to the best of our knowledge no restoration work has been attempted in a high energy braided mountain riverine system similar to the Snake river in Western Wyoming. With an average slope of 12 - 14 feet per mile and the composition of the riverbed being mainly glacial outwash or cobbles, any application of "typical" restoration measures, while considered, are not applicable to this system. Therefore any of the proposed restoration actions developed during the study of this system over the last several years is considered experimental in nature and untried. Thus the need for the "Demonstration" project.

The foundation of the demonstration project was to "field test" scaled down versions of the restoration "tools" that are being proposed in the larger Snake River Restoration Project. Both current and historical conditions in the Demonstration site have been documented through cross section survey and aerial photography providing a good basis for determining the effectiveness of the restoration tools. Using cross sections and photography taken in the Demonstration project site, the locations of several historical channels were identified. The desired condition in the area was to have two main channels running full during runoff periods to disperse runoff energy in as wide an area as possible. The channels would be defined by point bars and small islands with emergent vegetation during low flow periods.

It was also desirable to have one small low flow channel separated from the main channels by a large island with multi-story 25 – 50 year vegetative growth. This side channel would provide both spawning areas and overwintering habitat for trout. To achieve this, three sites along the low flow channel were chosen to have large pools excavated in or near the side channel. Additionally, to arrest the erosion of the main island, which provided protection for the low flow channel and ponds, it was proposed to install debris fences on the main channel side of the island. It was hoped that these fences would mimic the natural process of capturing debris and

sediments, allowing for natural vegetative growth to occur. At the same time the fences would provide the protection necessary for the vegetation to mature to the point where it could stabilize the newly formed stream bank.

This report will provide details of the project and the first year's results.

THE CONSERVATION PARTNERSHIP

The Teton Conservation District (TCD) is a legally organized Conservation District by Wyoming State Statues 11-16-101 through 11-16-134 as a legal subdivision of the State of Wyoming. As a nonprofit organization operating under locally elected District Supervisors, TCD's purpose is to develop and implement programs to protect and conserve soil, water, prime and unique farmland, rangeland, woodland, wildlife, energy and other renewable natural resources. Districts also stabilize local economies and resolve conflicts in land use. The District Supervisors address local needs through a responsible conservation ethic and are supported by the State of Wyoming. TCD has coordinated and cooperated on numerous resource oriented projects. In the past TCD has relied on federal and state partnerships but is very interested in developing long-term partnerships with non-governmental organizations to enhance the stability of our organizations future operations. This project provides not only the opportunity to benefit the resource by addressing the increasing population and development pressure, but also to showcase a conservation partnership. That partnership involves agriculture, local government, the Corps of Engineers, State and Federal wildlife resource organizations and agencies, as well as non-governmental organizations in a high profile setting that receives millions of tourists annually and receives national media attention.

The National Fish and Wildlife Foundation, through it's reputation for dedication to the conservation and management of fish, wildlife, plant resources, and the habitats on which they depend, was approached as both a short and long term partner in the current Snake River restoration effort. Interim results of the current study indicate that mitigation and rehabilitation of the varied natural habitats associated with the river can be achieved. As local sponsors, both Teton County and the Conservation District have forged a successful partnership with the U.S. Army Corps of Engineers. That partnership has been extended to local agricultural interests, whom still own a majority of the land along the river, to work together toward solutions serving conservation objectives.

The Wyoming Game & Fish Department provided important guidance in the development of the side channel habitat as well as important fisheries and water quality data for the area. Additionally, special recognition as a conservation partner needs to be given to David Owen. Without his generous contribution of equipment and time for gravel removal, screening, and replacement of oversize material, this project would not have been possible. His contribution was estimated at over $200,000.

THE RESTORATION STUDY

As co-sponsor, the Teton Conservation District is an integral part of the interagency Snake River Restoration Study. This study addresses the dynamics of the Snake River including hydrology, geology, geomorphology and the concerns over the loss of wetlands and valuable habitats along the River. The four year study began in 1996 and looked at methods of improving wetland areas, reducing the loss of riverine habitats, and conservation of existing fish habitat and the improvement of historical fisheries. This Study will ultimately lead to an ecosystem based river rehabilitation program. The overall study area runs along the leveed section (approximately 24 miles) of the Snake River from the southern boarder of Grand Teton National Park to the southern end of Jackson Hole. An objective of the study was to identify restoration methods that would not "force" the river to stabilize through direct intervention but rather to encourage stability and natural revegetation through minimally invasive measures.

In the Snake River, flow velocities in both main and secondary channels tend to be high, attributable to the general steep slope of the valley. Due to the high transport of bedload the channel complex is constantly changing. During high flows, avulsion of the main channel into side channels is a common occurrence. When flows erode gravel bars, the main channel can become clogged with debris and shift direction suddenly and unpredictably. However, the construction of the federal and non-federal levees blocked the lateral spread of the river and reduced the width of the floodplain and the degree of complexity of the braided system. This limited the ability of the channel to migrate and restricted avulsion activity to the area between the levees. This concentrates the flow in the main channel of the river during runoff thereby increasing the frequency of erosive attacks upon the islands and vegetation between the levees. These artificially high energy flows and subsequent erosion prevents the natural recovery of the islands and vegetation within the river system. Bedload material brought into suspension by turbulent flow are now more likely to be carried through the system rather than be carried laterally into the slower secondary channels where the material could be redeposited over a wider area of the floodplain.

Upon review of the preliminary data during the study, including historic cross sections and aerial photography, a number of promising restoration concepts were developed. These "tools" such as planned channel excavation, pool creation, debris fences, and kicker dikes were designed to restore and protect stream bank riparian habitat in the Snake River. They had the potential to stabilize historic river channel configurations, restore flood flow carrying capacity, improve pool/riffle ratios, and enhance fish habitat while decreasing flow impingement pressure on levees. To test the experimental nature of the designs, the Demonstration Project was created to demonstrate the effectiveness of the restoration "tools" on a reduced scale prior to the completion of the overall study. Therefore if any modification were necessary then changes could be made before implementing the restoration plan in it's entirety.

THE DEMONSTRATION PROJECT

The Demonstration Project, which provided an opportunity to test proposed rehabilitation methods and contributed new information, was completed in the Fall/Winter of 1998 in the area of the Wilson Bridge on the Snake River. The Demonstration Project had three main objectives. The first objective being stabilization and restoration of streambank and riparian habitats along the Snake River by encouraging the natural island rebuilding processes (successional processes). Upstream of the Wilson bridge it was proposed to restore an existing island to pre-1986 surface area, an increase of approximately two acres. This was accomplished through by the use of pile driven "brush fences". The fences snag and trap woody debris during peak spring flows thereby reducing water velocity, causing silts and sediments to be deposited. Newly deposited sediments create a favorable environment for "volunteer" wetland and scrub-shrub vegetation. The wetland/scrub-shrub plant community will trap additional sediments which will in turn promote riparian cottonwood growth and stabilize streambank.

A secondary objective is stabilization of the river channel and restoration of the flood capacity in the area of the Wilson Bridge. This was accomplished through planned extraction of riverbed material to encourage enhanced channel stability and restore the carrying capacity of the levee reach in the Wilson bridge area[1]. An estimated 54,000 cubic yards of bedload material was to be removed from an aggraded area immediately adjacent to, and extending up the west bank upstream of, the Wilson bridge. The bedload material was to be transported to the existing gravel processing site adjacent to the proposed restoration area and processed for the purpose of separating all material ≥4" in diameter. This oversize material was returned to the excavated channel to aid in the natural "armoring" of the river channel. The final objective was to improve fisheries habitat through the removal of bedload material in an historic low flow river channel to create a series of pools and riffles. An estimated 16,000 cubic yards of additional bedload material was to be removed to accommodate the creation of pools for fish habitat.

TCD was responsible for obtaining the required permits, including writing an Environmental Assessment for the Wyoming Bureau of Land Management who has jurisdiction over a portion of the project area, project oversight and administration. The Natural Resources Conservation Service (NRCS) assisted with the field survey. The USACE Planning division provided hydrology, construction oversight, and engineering expertise. USACE Operation & Maintenance division constructed the kicker dike adjacent to the Federal levee in the project area. David Owen of River Springs Partners removed the estimated 54,000 cubic yards of bedload material from the river. Mr. Owen contributed the cost of the removal of the material, screening, and replacement of oversize, estimated at $210,000, as in-kind to the project. Wyoming Game and Fish Department provided fish survey and water quality data on the ponds.

[1] Excavation design attached

CONSTRUCTION

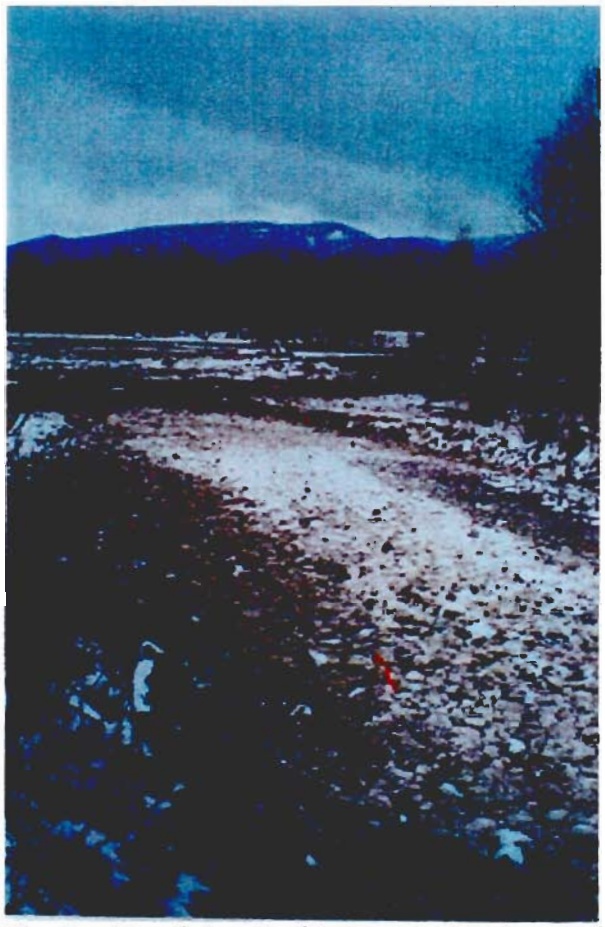
Debris Fences -

Beginning November 1, 1998 the Demonstration Project was initiated with the three phases, main channel excavation, brush/debris fence construction, and pool excavation commencing simultaneously. Elevations and placement of the termination points of each of the five fences were established by U.S. Army Corps of Engineers (USACOE) personnel with the brush/debris fences being completed by Teton County staff near the end of November. The excavation phase of the project was completed by mid-February.

The cost of the fences was considerably higher than the original estimate of $15,000. The final cost was $26,893.75, approximately $12,000 over estimate. It should be noted that the estimates for this phase of the project were very speculative due to the experimental nature of the fences. Given the hands on experience constructing these restoration components on the relatively small scale of the demonstration project, cost estimates for the much larger restoration areas can now be made with a much greater degree of accuracy.

Pools -

Upon an area field survey by USACOE and Wyoming Game & Fish personnel in which the pools were to be excavated, it was decided to reduce the number of pools to be excavated from six, as originally planned from aerial photography, to three. Consideration was given to existing topography, stability of the historic overflow channels and the level of disturbance to vegetation that would be experienced during excavation. A total volume of 6334 cubic yards of material was removed from the three pools. While only one of the pools has any direct contact with the river, groundwater filled each of the pools with the lower pool experiencing enough infiltration that it established a steady outflow of 1-2 cfs. These pools were periodically checked throughout the winter by Wyoming Game & Fish personnel to determine if oxygen levels in the water would be sufficient to support overwintering fish populations.



The site pictured above is of the lower pool at the end of an abandoned channel

Corps of Engineers personnel supervising the excavation of the lower pool

Completed lower pool prior to runoff

While the initial cost of the excavation of the pools was well below estimates, two elements arose that should be considered in future projects of this nature on multi-jurisdictional managed lands. The pools were located on Bureau of Land Management property and therefore the excavated material could not be sold. An arrangement was made with Teton County to stockpile the material at a privately owned quarry in the area in which the County held a lease agreement. The material would then be used in future river restoration or maintenance projects as required. The terms of the agreement and an ongoing legal action required that personnel be placed at the gated entrance to insure that material was only taken into the quarry and not removed. Also, an easement for the haul road had been obtained with the landowner on whose property the road crossed. A condition of the easement was to have personnel placed at a gate on the property to insure that livestock did not pass. The addition of personnel created an unforeseen cost for the excavation.

These "before and after" photos are of the middle pool area. This area is about midway down the secondary overflow channel on the island. The water shown in the left photo appeared during excavation and is being supplied by groundwater percolation. This minimal level was sustained throughout the winter.

Channel Management **-**

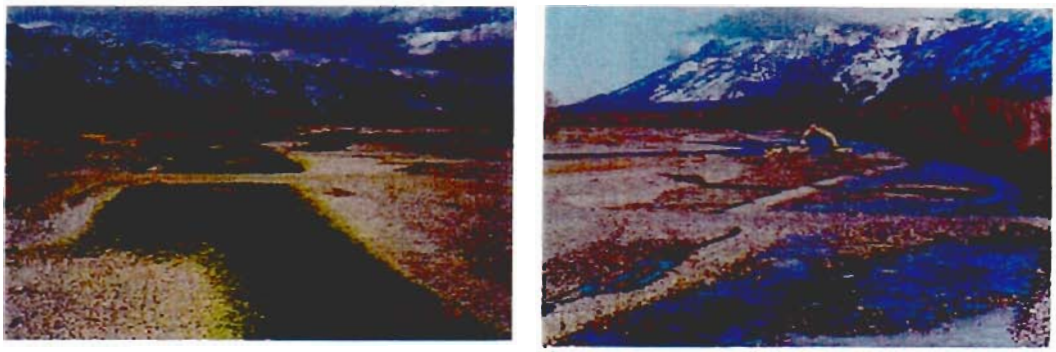
Prior to commencement of the main channel excavation USACOE and District

personnel performed a field survey to establish the specific dimensions of the excavation. Cross sections surveyed at 100 foot intervals, extending from 300' south of the Wilson bridge to 1200' north of the bridge, were recorded and will serve as the basis for future monitoring. The initial draft plan for the excavation was based on the desired final dimensions of the finished channel modification and had not taken into account the instability of the material within the channel during spring and summer flows. After review of the field survey it was decided to decrease the surface area of the excavation by approximately one third given the amount of material in the proposed excavation site. New plans were provided to Owen's Excavation Inc. and the excavation was begun.

After the material was removed from under the bridge, the operation moved upstream to some of the larger gravel bars.

Channel management activity required additional heavy equipment in the immediate area of the Wilson Bridge. Aggradation of material was so excessive that the riverbed was lowered up to thirteen feet in this area. A small bulldozer was used to push the material out to the backhoe so that it could be loaded into the dump trucks

To accommodate the special conditions of the 404 permit and to address concerns of the Department of Environmental Quality and the Wyoming Game & Fish Department, the excavation of the channel was accomplished in two phases. The first phase included the installation of a 36" corrugated metal pipe to accommodate an existing flow in a side channel of approximately 100 cfs that was on the west bank of the river. The placement of the pipe served several purposes. It allowed for dry access to the eastern side of the excavation while allowing for a continued flow through the side channel in case fish were present. Once the pipe was in place the flow was then reduced to approximately 25 cfs by the placement of rock in the upper inlet of the side channel. This measure incrementally dewatered a majority of the side channel thereby insuring all work would take place in the dry, while allowing for a minimum flow necessary (and minimal impact) for any aquatic organisms present.



The process of gradual dewatering one half of the excavation at a time provided a method of extracting bedload material "in the dry" while minimally impacting water quality and existing fish populations.

Work was initiated on the downstream end of the eastern half of the excavation and proceeded to the upstream end. Once the material had been removed down to the desired elevation on the eastern half of the excavation, the streamflow down the western side of the excavation was allowed to flow into the excavated eastern half effectively dewatering the western half. The shifting of the minimum flow was accomplished with little impact to water quality in the main stem of the river. Periodically throughout the duration of the project water quality testing was performed by TCD staff above and below the work site using an EPA approved DH integrated sampler. Sampling methodology included working across a section of the main channel of the river moving the sampler vertically through the water column at 10 foot intervals. The cross section sampled on the downstream end was 100' below the confluence of the main channel of the river and the side channel to provide an appropriate mixing zone. Samples then were sent via Federal Express to the Wyoming State Lab for analysis for Turbidity and Total Suspended Solids. A maximum increase limit of 10 NTU's has been established as a condition of the 404 permit. Results from analysis determined that turbidity did not exceed an increase of more than 1 NTU and suspended solids increased an average of 1-2 mg/l, far below the established thresholds.

After the side channel flow had stabilized in the eastern side of the excavation, work began on the downstream end of the western side. Unfortunately as work began on this section little snow (which inhibits ground frost) had fallen in the area and two weeks of subzero temperatures drove the frost level in the ground down about five feet. This slowed progress considerably and it became apparent that the February 1 stop work order, due to the Bald eagles in the area, would have to be exceeded in order to facilitate placement of the screened oversize cobble (4" and larger) back in the excavated area to provide armoring. After a consultation with Pat Diebert of the U.S. Fish & Wildlife Service, it was agreed to extend the work window primarily due to the location of the permitted year round gravel processing site which was closer to the nests than the extraction site. The excavation was completed with a total of 36,208 cubic yards being removed.

MONITORING

Monitoring of the demonstration project area is a vital component of the overall study of restoration techniques on the Snake River system. Data obtained will be used to make adjustments to the restoration methodology. Once the impacts are more clearly understood and the effectiveness is validated, the tools can then be applied more effectively in the other Study areas along the Snake River. A number of separate monitoring methods are utilized to observe the variety of restoration measures used in the area.

Debris Fences -

The function of the debris fences was to catch floating debris, creating areas of diminished velocity both immediately up and down stream of the fence. In these areas the relatively slow velocities created an area for the sediments suspended in the runoff to drop out and accumulate. As runoff flows recede, this sediment deposition creates a nutrient rich environment in which shrub/scrub vegetative and grass species can establish viable populations quickly. This growth in turn stabilizes the sediment and the soil building process begins. Soon tree species begin to colonize the area which will provide long-term bank stabilization. The fences were built to afford "50 year" protection after which natural growth will provide protection.

To establish sediment gain / loss, elevations were surveyed between the fences both pre and post runoff. These elevations combined with photo points and vegetation transects will provide evidence of both the quantity of sediment captured and rate of vegetative colonization.

Prior to the 1999 runoff event this area was composed primarily of cobble and gravels. Post runoff observations reveal that silts and nutrient rich sediments were deposited.

Pools -

The pools were dug to create fisheries habitat for resting, overwintering, and spawning. Fish population surveys have been completed by Wyoming Game & Fish personnel in this area. These surveys will be repeated in the future and will show any increase in quantity of fish due to the improvements in the area. It will be difficult to justify the changes in population in the area to the pools. Monitoring that directly correlates to the success pool habitat includes recording the rate of sediment accumulation through survey, flow calculations, dissolved oxygen measurements in the winter, and visual observation.

Upper Pool nine months after construction.

Channel Management -

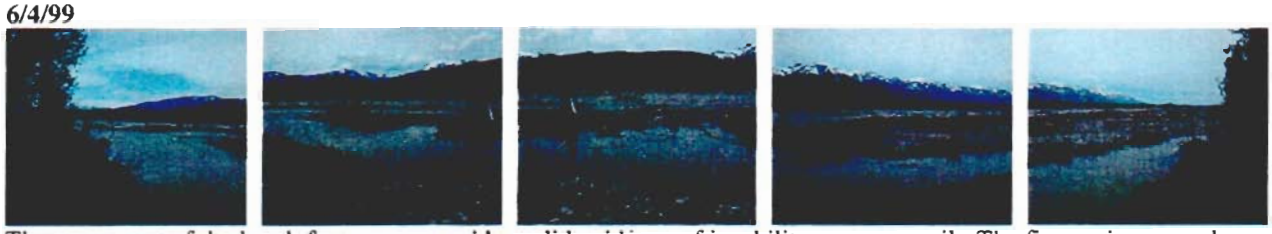
In an attempt to understand the causal effects of bedload movement and erosion with channel and point bar formation several survey tools were used. Through the use of aerial photography the extent and rate of destruction of island habitat in the area has been documented from 1944 to the present. Using recent photography, two foot contours of the area have been plotted to be used as a baseline in order to determine the increase in the total area of the island. Additionally, cross sections of the river at 100 foot intervals from 300' below the Wilson bridge to 1800' above the bridge are surveyed during low flows each year. Once analyzed, this data should provide some indication of the effects channel excavation and placement of debris fences have had on channel/point bar geomorphology and hydrology. Photo points were also used to provide a visual record during runoff events.

FINDINGS

Debris Fences -

The primary function of the debris fences was to trap debris thereby facilitating the deposition of sediment. As they meet their primary function the fences act as catalyst for the island creation process that naturally occurs in the Snake River floodplain. This restoration tool can then be used in areas where islands were historically located and to augment the few remaining islands to enlarge them to their historic proportions. Evidence of the success of the fences is indicated in this panorama series of photos.

6/4/99



The upper part of the brush fence area provides solid evidence of its ability to capture silt. The first series was taken at river flows of 15,900 cubic feet per second. Water had first appeared the day before in the fenced area and is "subbing" up e.g. ground water pooling at this point. Note the distance the main channel of the river is from the end of the fences. At low flow the edge of the channel was at least 40 meters out from the fence in this location.

6/25/99

The second series (17,200 cfs) was taken the first day that the site could be accessed after peak runoff (20,600 at 6/18/99). The fenced area has had river flows passing through for about 15 days at this point. Note the heavy current impinging on the end of the fence at left and the main channel of the river moving into the fenced area but being diverting back away by the fences.

7/9/99

Spring runoff flows have receded to 8,800 cfs in this series. Significant deposition of nutrient rich sediment (up to 18" in most areas) has occurred with the fences functioning as expected.

While the debris fences functioned as expected, they also provided an unanticipated level of direct protection to the area. Not intentionally designed to endure a direct impingement from high velocities, up to 15 feet per second in this case, they performed beyond expectation. Prior to runoff the closest edge of the main channel of the river was 40 meters from the fenced area. During runoff the main channel shifted from river right to river left entering the fenced area from the side rather than from upstream. Acting like kicker dikes, the fences kept the main energy of the flow away from the island. While there was some damage to several of the fences, (four of the outer posts (6" well casing) were bent in half) if they had not been in place there is a high probability that the lower one third of the island would have been destroyed.

Other debris fence observations of note:

The photo at left illustrates the typical composition of the riverbed in the area of the debris fences prior to runoff. Cobble and gravels constitute the majority with some sand and a little silt. The vegetation is comprised of cool climate grasses and weeds.

This photograph at right, taken June 21st @ 19,600 cfs, shows the fences underwater. The flow at upper end of the fenced area did not have significant velocity, estimated at 2 feet per second. The middle and lower end however experienced high energy impingement, estimated between 10 – 15 feet per second as the main channel avulsed toward the island. You can see the standing waves created by fences three and four near the center of the photo.

Debris fences # three and four at left are acting similar to kicker dikes and deflecting the main energy of the flow (19,000 cfs) away from the island. The hydraulic "head" created by the debris lodged in the fences and impeding flow through the fence and creating "back pressure" was responsible for keeping the flow from entering the area in between the fences.

This is a good representation of the type of material captured by the fences. Note the deep scour hole at the end of the fence. While the end of this fence was damaged from the high flow, the result created excellent fish habitat.

Pools -

Two of the three pools were positioned in an overflow channel that did not receive direct flow from the river for a majority of the year. There was evidence of very high ground water infiltration which would keep water levels in the pools at acceptable levels throughout the year. There was some concern of how well the pools in the overflow channel would stand up to direct flows from the river. The third pool was placed off channel but it was expected that it would fill from groundwater recharge. In summary, all pools performed as expected during the runoff period.

A second concern was how well the pools would support overwintering populations of fish. Wyoming Game & Fish personnel monitored the pH and dissolved oxygen levels throughout the winter. The results, shown below, indicated that the lower and upper pools had favorable water chemistry to support fish, while the middle pool did not. No supported hypothesis has yet been developed to provide an explanation for the low dissolved oxygen levels in the middle pool.

SNAKE RIVER COE DEMONSTRATION PROJECT - AREA 9 PONDS

WATER	DATE	AIR	H20	DO	pH	REMARKS
Lower Pool	12/11/98	26F	42F	7 ppm	None	ICE FREE / CLEAR WATER
	1/12/99	35F	40F	10 ppm	8.2	ICE FREE / CLEAR WATER
	2/16/99	36F	ICE	6 ppm	7.7	2" CRUD ICE / CLEAR WATER
	3/17/99	55F	ICE	7 ppm	7.5	EDGE ICE FREE/CLEAR WATER
	4/14/99	45F	47F	9 ppm	8.7	ICE FREE/CLEAR WATER
	5/14/99	50F	46F	7 ppm	8.7	SAME FLOW
Middle Pool	12/11/98	26F	ICE	8 ppm	7.7	2" ICE / CLEAR WATER
	1/12/99	35F	ICE	2 ppm	7.8	7" ICE / CLEAR WATER
	2/16/99	36F	ICE	3 ppm	8.7	7" ICE / CLEAR WATER
	3/17/99	55F	ICE	11ppm	8.7	6" ICE / CLEAR WATER
	4/14/99	45F	52F	8 ppm	8.3	EDGE ICE FREE/CLEAR WATER
	5/14/99	50F	46F	7 ppm	8.7	WATER FLOW INTO POND
Upper Pool	12/11/98	26F	ICE	8 ppm	7.7	1.5" ICE / CLOUDY WATER
	1/12/99	35F	ICE	9 ppm	8.5	1/2 ICE FREE / CLEAR WATER
	2/16/99	36F	ICE	9 ppm	8	4" CRUD ICE/ CLEAR WATER
	3/17/99	55F	ICE	10ppm	9	4" CRUD ICE / CLEAR WATER
	4/14/99	45F	50F	9 ppm	8	EDGE ICE FREE/CLEAR WATER
	5/14/99	50F	50F	9 ppm	8.9	CLEAR WATER

While the lower pool was transformed by erosion early in the runoff period on the lower end into a back eddy by the main river for several weeks, when the river levels dropped a natural coffer dam formed and an adequate water elevation was retained in the pool. The middle pool's configuration did not change although some deposition of sediment occurred during runoff. While there was no direct inlet to the upper pool, during high water outflow discharge was observed as high as 3 – 4 cfs. There was no turbidity observed in this pool at any time. Please refer to field notes on the following page.

Field Notes

5/29/99 - 18,000 cfs
Overflow channel @ 70 cfs. Pool #1 lower end eroding out.

6/1/99 - 15,000 cfs
Overflow channel @ 5 cfs.

6/7/99 - 15,600 cfs
Overflow channel @ 35 cfs.

6/14/99 – 15,700 cfs
Overflow channel @ 5 cfs but outflow @ 20 cfs indicating significant groundwater infiltration.

6/15/99 - 18,000 cfs
Overflow channel @ 10 cfs, outflow @ 25 cfs. Lower and middle pools have water backing in from the channel at the lower end. Main river channel is avulsing to the east.

6/17/99 - 19,400 cfs
Overflow channel @ 15 cfs. Lower pool filled completely with backwater from river.

6/19/99 - 20,100 cfs
Overflow channel @ 25 cfs.

6/23/99 - 18,900 cfs
Major inflow reduction although outflow from lower pools is down only slightly. Low turbidity indicates

Strong groundwater infiltration. Preliminary observation indicates lower pool did not headcut and lower reach is intact! Observed fish rising in lower pool.

7/1/99 - 9,800 cfs
Inflow absent, good outflow. Sandbar formed at the mouth of lower pool enhancing water storage.

Lower Pool Study Photos

The middle and upper pools experienced a far lesser degree of change in structure as evidenced in the study photos on the following pages.

Middle Pool Study Photos

This is the largest pool covering almost one acre. At the far end in the photograph a deep hole was dug as a resting area for fish that is out of the main current. The area in the foreground is much shallower and constitutes the overflow channel floodway.

5/27/99	6/4/99	6/11/99
		
6/23/99	**7/1/99**	**7/13/99**
		

Upper Pool Study Photos

The following three panoramas were taken from different perspectives but are still fairly representative of the upper pool's configuration. In the second series you can see the overland outflow from the pool. While there was no direct inflow into the pool groundwater infiltration supplied a fresh source of water. Currently this pool is being utilized for waterfowl and no fish have been introduced. Wyoming Game & Fish personnel are considering stocking the pool as it has proven to be able to support fish. Additional cover will have to be used to protect the fish from the Osprey and Bald eagles in the area.

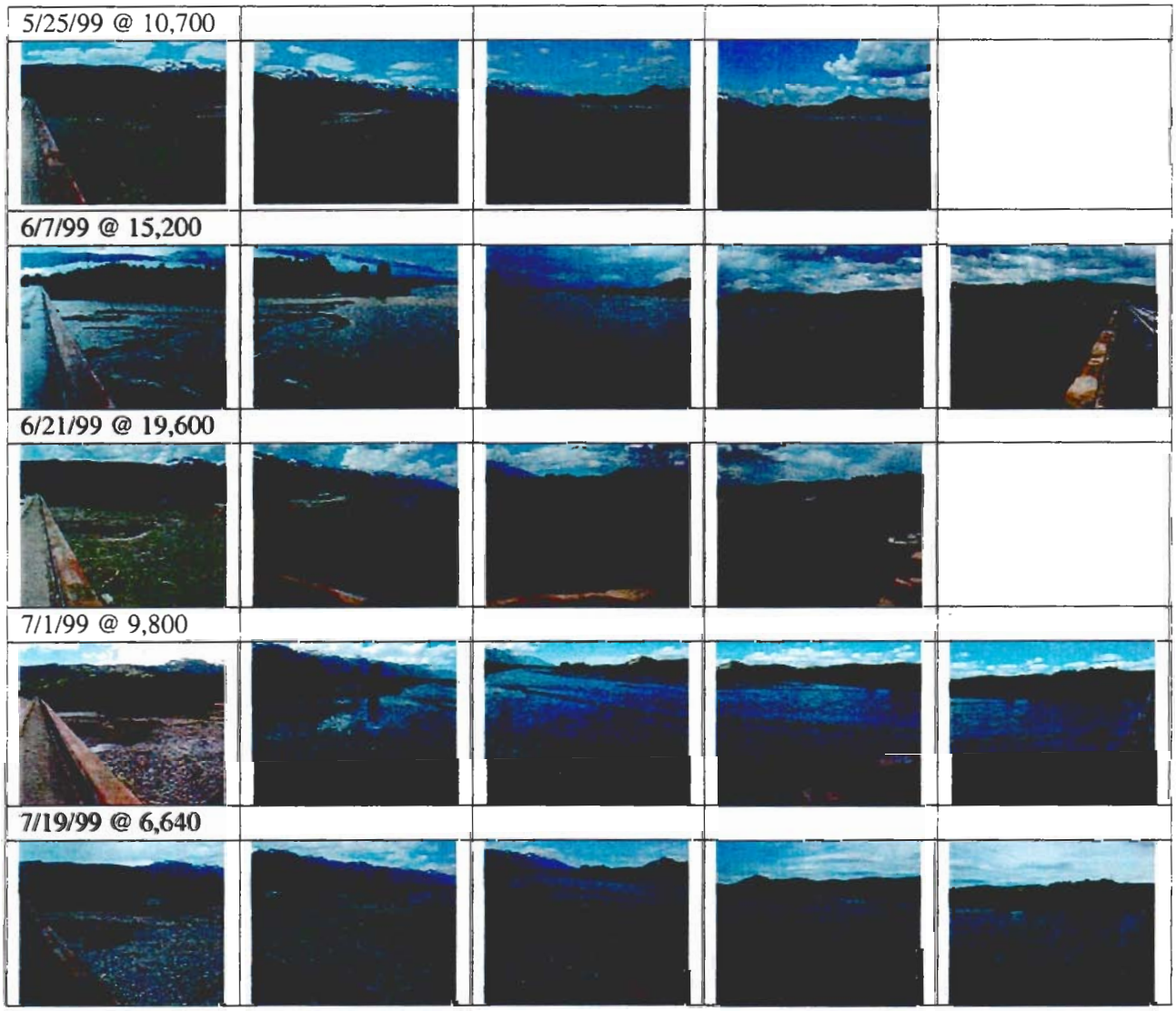
5/27/99

6/11/99

6/25/99

Channel Management -

When the islands are restored within the levee system, the river channels must be deepened to accommodate the loss of floodway conveyance created by more surface area. In river restoration efforts, opportunities exist to increase flood capacity while concurrently attempting to stabilize the channel through planned bedload extractions. In the demonstration project area it was desired to have a single channel adjacent to the island and have it split into two channels below[2]. Note in the following photo point record, the main channel established itself as planned. Unfortunately the secondary channel excavation in front of the boat ramp filled back in with bedload material almost immediately upon commencement of runoff. However, even though the channel management activity was not totally successful, a great deal of data was compiled which when analyzed will provide important information on river hydrological and geomorphological processes.



The debris fences and pools are located on the island in the background on the right side.

[2] see attached excavation plan